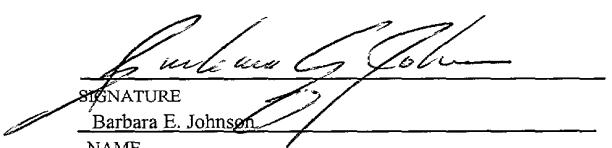


Form PTO-1390 (REV 10-95) <b>TRANSMITTAL LETTER TO THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US) CONCERNING A FILING UNDER 35 U.S.C. 371</b>		U.S. DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE  ATTORNEY'S DOCKET NUMBER <b>702-010062</b>
INTERNATIONAL APPLICATION NO. <b>PCT/EP99/05759</b>		U.S. APPLICATION NO. (If known) (cc 371(FP)) <b>09/762778</b>
INTERNATIONAL FILING DATE <b>06.08.99 (August 6, 1999)</b>		PRIORITY DATES CLAIMED <b>14.08.98 (August 14, 1998)</b>
TITLE OF INVENTION <b>MINERAL WOOL PLANT SUBSTRATE</b>		
APPLICANT(S) FOR DO/EO/US <b>Anton BLAAKMEER and Paul J. L. H. BOUWENS</b>		
<p>Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:</p> <ol style="list-style-type: none"> <li>1. <input checked="" type="checkbox"/> This is a <b>FIRST</b> submission of items concerning a filing under 35 U.S.C. 371.</li> <li>2. <input type="checkbox"/> This is a <b>SECOND</b> or <b>SUBSEQUENT</b> submission of items concerning a filing under 35 U.S.C. 371.</li> <li>3. <input checked="" type="checkbox"/> This express request to begin national examination procedures (35 U.S.C. 371(f)) at any time rather than delay examination until the expiration of the applicable time limit set in 35 U.S.C. 371(b) and PCT Articles 22 and 39(1).</li> <li>4. <input checked="" type="checkbox"/> A proper Demand for International Preliminary Examination was made by the 19th month from the earliest claimed priority date.</li> <li>5. <input checked="" type="checkbox"/> A copy of the International Application as filed (35 U.S.C. 371(c)(2)) <ul style="list-style-type: none"> <li>a. <input type="checkbox"/> is transmitted herewith (required only if not transmitted by the International Bureau).</li> <li>b. <input checked="" type="checkbox"/> has been transmitted by the International Bureau.</li> <li>c. <input type="checkbox"/> is not required, as the application was filed in the United States Receiving Office (RO/US)</li> </ul> </li> <li>6. <input type="checkbox"/> A translation of the International Application into English (35 U.S.C. 371(c)(2)).</li> <li>7. <input checked="" type="checkbox"/> Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371(c)(3)) <ul style="list-style-type: none"> <li>a. <input type="checkbox"/> are transmitted herewith (required only if not transmitted by the International Bureau).</li> <li>b. <input type="checkbox"/> have been transmitted by the International Bureau.</li> <li>c. <input type="checkbox"/> have not been made; however, the time limit for making such amendments has NOT expired</li> <li>d. <input checked="" type="checkbox"/> have not been made and will not be made.</li> </ul> </li> <li>8. <input type="checkbox"/> A translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)).</li> <li>9. <input type="checkbox"/> An oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4)).</li> <li>10. <input type="checkbox"/> A translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371(c)(5)).</li> </ol> <p>Items 11. to 16. below concern document(s) or information included:</p> <ol style="list-style-type: none"> <li>11. <input type="checkbox"/> An Information Disclosure Statement under 37 CFR 1.97 and 1.98</li> <li>12. <input type="checkbox"/> An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.</li> <li>13. <input checked="" type="checkbox"/> A <b>FIRST</b> preliminary amendment <ul style="list-style-type: none"> <li><input type="checkbox"/> A <b>SECOND</b> or <b>SUBSEQUENT</b> preliminary amendment.</li> </ul> </li> <li>14. <input type="checkbox"/> A substitute specification.</li> <li>15. <input type="checkbox"/> A change of power of attorney and/or address letter</li> <li>16. <input checked="" type="checkbox"/> Other items or information: <ul style="list-style-type: none"> <li>a. WO 00/08919-Front Page with Abstract, specification and claims (12 pp.)</li> <li>b. Search Report (3 pp.)</li> <li>c. International Preliminary Examination Report With Annex (6 pp.)</li> </ul> </li> </ol>		

U.S. APPLICATION NO. (if known) (37 CFR 1.495)		INTERNATIONAL APPLICATION NO. PCT/EP99/05759	ATTORNEY'S DOCKET NUMBER 702-010062
17. <input checked="" type="checkbox"/> The following fees are submitted: <b>BASIC NATIONAL FEE (37 CFR 1.492(a)(1)-(5)):</b> Search Report has been prepared by the EPO or JPO. .... ..... \$860.00 International preliminary examination fee paid to USPTO (37 CFR 1.482) ..... ..... \$690.00 No international preliminary examination fee paid to USPTO (37 CFR 1.482) but international search fee paid to USPTO (37 CFR 1.445(a)(2)).... .... \$710.00 Neither international preliminary examination fee (37 CFR 1.482) nor international search fee (37 CFR 1.445(a)(2)) paid to USPTO..... ..... \$1000.00 International preliminary examination fee paid to USPTO (37 CFR 1.482) and all claims satisfied provisions of PCT Article 33(2)-(4)..... ..... \$100.00			<u>CALCULATIONS PTO USE ONLY</u>
<b>ENTER APPROPRIATE BASIC FEE AMOUNT =</b>			<b>\$ 860.00</b>
Surcharge of \$130.00 for furnishing the oath or declaration later than <input type="checkbox"/> 20 <input checked="" type="checkbox"/> 30 months from the earliest claimed priority date (37 CFR 1.492(e)).			<b>\$ 130.00</b>
CLAIMS	NUMBER FILED	NUMBER EXTRA	RATE
Total claims	16 - 20	0	X \$18.00 \$ 0.00
Independent claims	3 - 3 =	0	X \$80.00 \$ 0.00
MULTIPLE DEPENDENT CLAIM(S) (if applicable)			+ \$270.00 \$ 0.00
<b>TOTAL OF ABOVE CALCULATIONS =</b>			<b>\$ 990.00</b>
Reduction of 1/2 for filing by small entity, if applicable. Small Entity Statement verified by Applicant(s) attorney.			\$ 0.00
<b>SUBTOTAL =</b>			<b>\$ 990.00</b>
Processing fee of \$130.00 for furnishing the English translation later than <input type="checkbox"/> 20 <input type="checkbox"/> 30 months from the earliest claimed priority date (37 CFR 1.492(f)).			\$ 0.00
<b>TOTAL NATIONAL FEE =</b>			<b>\$ 990.00</b>
Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31). \$40.00 per property			+ \$ 0.00
<b>TOTAL FEES ENCLOSED =</b>			<b>\$ 990.00</b>
			Amount to be: refunded \$
			charged \$
a. <input checked="" type="checkbox"/> A check in the amount of <b>\$ 990.00</b> to cover the above fees is enclosed. b. <input type="checkbox"/> Please charge my Deposit Account No ____ in the amount of \$ ____ to cover the above fees. A duplicate copy of this sheet is enclosed. c. <input checked="" type="checkbox"/> The Assistant Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to Deposit Account No <u>23-0650</u> . A duplicate copy of this sheet is enclosed.			
<b>NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137(a) or (b)) must be filed and granted to restore the application to pending status.</b>			
SEND ALL CORRESPONDENCE TO Barbara E. Johnson 700 Koppers Building 436 Seventh Avenue Pittsburgh, Pennsylvania 15219-1818 Telephone: (412) 471-8815 Facsimile: (412) 471-4094			
 _____ SIGNATURE Barbara E. Johnson _____ NAME 31,198 _____ REGISTRATION NUMBER			

PATENT APPLICATION/PCT  
Attorney Docket No. 702-010062

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

In re application of :  
  
Anton BLAAKMEER : MINERAL WOOL PLANT SUBSTRATE  
Paul J. L. H. BOUWENS :  
  
International Application :  
No. PCT/EP99/05759 :  
  
International Filing Date :  
6 August 1999 :  
  
Priority Dates Claimed :  
14 August 1998 :  
  
Serial No. Not Yet Assigned :  
  
Filed Concurrently Herewith :  
  
Pittsburgh, Pennsylvania  
February 13, 2001

**PRELIMINARY AMENDMENT**

**BOX PCT**

Assistant Commissioner for Patents  
Washington, DC 20231

Sir:

Prior to initial examination, please amend the above-identified patent application as follows:

**IN THE SPECIFICATION:**

Page 1, after the title, insert the following headings:

**--BACKGROUND OF THE INVENTION**

1. **Field of the Invention--**

Page 1, after line 8, insert the following heading:

--2. Description of the Related Art--.

Page 2, after line 2, insert the following heading:

--SUMMARY OF THE INVENTION--.

Page 3, after line 13, insert the following heading:

--DESCRIPTION OF THE PREFERRED EMBODIMENTS--.

**IN THE CLAIMS:**

Original claim 1 was amended during Chapter II proceedings by substituting new claim 1 in a letter dated October 19, 2000. Please cancel original claims 1-11 and cancel amended claim 1 and rewrite them as new claims 12-27 as follows.

--12. A mineral wool plant substrate comprising a coherent matrix of mineral wool and up to 20 volume % of an ion-exchange agent comprising an ion-exchange capacity of at least about 15 meq/100g dry weight, wherein the ion-exchange agent has a stable structure, exhibiting a non-clay like behaviour with respect to swelling and shrinkage.

13. The substrate according to claim 12, wherein the ion-exchange agent is a cation-exchange agent.

14. The substrate according to claim 12, wherein the ion-exchange agent comprises soil minerals.

15. The substrate according to claim 12, wherein the ion-exchange agent has a non-clay like behaviour with respect to swelling and shrinkage.

16. The substrate according to claim 12, wherein the ion-exchange agent has an average pore size smaller than the average pore size of mineral wool having a density of less than about 72 kg/m<sup>3</sup>.

17. The substrate according to claim 12, wherein the ion-exchange agent comprises a zeolite.

18. The substrate according to claim 12, further comprising an organic substance, substituting the mineral wool for up to 20 volume %.

19. The substrate according to claim 12, further comprising clay, substituting the mineral wool for up to about 20 volume %.

20. The substrate according to claim 12, for use as a growing block.

21. A growing mat comprising the substrate of claim 12.

22. A substrate comprising a coherent matrix of mineral wool, a pre-determined amount of clay and a pre-determined amount of an organic substance, substituting the mineral wool for up to 20 volume %.

23. The substrate according to claim 22, wherein the organic substance is selected from the group consisting of sphagnum and peat.

24. The substrate according to claim 15, wherein the ion-exchange agent has a stable zeolite, cage-like structure.

25. The substrate according to claim 12, wherein the ion-exchange agent has an ion-exchange capacity of about 30 meq/100g dry weight.

26. The substrate according to claim 12, wherein the ion-exchange agent has an ion-exchange capacity of about 40 meq/100g dry weight.

27. The substrate according to claim 18, wherein the organic substance is selected from the group consisting of sphagnum and peat.--

**IN THE ABSTRACT:**

After the claims, please insert a page containing the Abstract Of The Disclosure, which is attached hereto as a separately typed page.

**REMARKS**

The specification has been amended to place it into conformance with standard United States Patent practice.

Under date of October 19, 2000, Applicants submitted a substitute sheet containing amended claim 1 for the above-identified PCT application. Original claims 1-11 and amended claim 1 have been canceled by this Preliminary Amendment and rewritten as new claims 12-27 to eliminate the multiple dependencies and to bring the claims into conformance with standard United States Patent practice.

An Abstract Of The Disclosure has been added as a separately typed page to be inserted after the claims.

Entry of this Preliminary Amendment is respectfully requested.

Respectfully submitted,

WEBB ZIESENHEIM LOGSDON  
ORKIN & HANSON, P.C.

By 

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## MINERAL WOOL PLANT SUBSTRATE

The present invention relates to a mineral wool plant substrate, more in particular to a mineral wool plant substrate comprising a foreign material or materials in order to improve the properties of the 5 mineral wool substrate to realize Crop Protection and/or improve plant performance in relation to additions (such as nutrients, pesticides, water and the like) as applied by growers during a cropping cycle.

Mineral wool plant substrates for plant growth 10 are well-known in the art and consist of a coherent matrix of mineral wool. This coherent matrix is formed by collecting a layer of mineral wool fibres provided with a curable binder, so that after curing the mineral wool fibres are substantially not displaceable relative to one 15 another. If required for fast uptake of water this coherent matrix of mineral wool may be provided with a wetting agent.

Under mineral wool is to be understood glass wool, stone wool, rock wool, man made vitrous fibres, 20 slag wool, and/or mixtures thereof.

The fibres may have an average diameter varying in between 1-10  $\mu\text{m}$ . For rock wool the fibre diameter is on average about 4  $\mu\text{m}$ .

The density of the coherent matrix of mineral 25 wool may be between 10-200 kg/m<sup>3</sup>, in general in the range of 40-80 kg/m<sup>3</sup>.

Such a coherent matrix of mineral wool has a form retaining property, which is inherent due to the inorganic starting materials used. Furthermore, the water 30 retaining capacity of these mineral wool plant substrates is very well controllable and predictable.

A problem is that growers, utilizing such mineral wool plant substrates may inadvertently stress and even damage plants by overdosing or underdosing the 35 mineral wool substrates with additions, such as nutrient

solutions, when considering plant requirements at a certain time and growth stage.

An object of the present invention is to provide an improved mineral wool plant substrate, which 5 aims to overcome this problem.

According to a first aspect of the present invention there is provided a mineral wool plant substrate according to claim 1.

In soil, plants extract their necessary 10 compounds such as essential nutrients from available compounds in the soil water. If the amount of compounds in the soil water either exceeds or is less than the amount required by the plant, these compounds will be respectively released or stored on charged soil 15 particles. This can be quantified as the ion exchange capacity (IEC). These soil particles may contain both a fixed and/or a variable IEC (variable meaning that the amount of IEC is dependent on other parameters such as pH, water content and structure).

20 The mechanism of release and storage is based on the chemical equilibria of compounds between soil particles and the soil water solution and/or soil particles and soil air solution.

This IEC and the mechanism for release and 25 storage of compounds in soils not only works for ions, but is also appropriate for compounds which are electrically neutral, but due to their chemical structure contain strong positive and negative dipole charges, examples being water and organic compounds such as 30 carbon-acids and alcohols.

This mechanism for exchanging and storage of compounds and IEC is however lacking in mineral wool plant substrates. Therefore, if growers over or underdose mineral wool substrates with for example nutrients and 35 pesticides, this can have a severe negative effect on the plants (such as stress, damage and the like) resulting in a suboptimal growth response, both qualitatively and

quantitatively. The plant stress induced in this way, can even result in the induction of plant diseases.

The inventors have shown that by adding an ion exchange agent containing a fixed and/or variable IEC to 5 mineral wool plant substrates, vital compounds are buffered therewithin. This means that if a grower adds an over or under dose of compounds to the plant substrate the plant is substantially prevented from negative effects thereby.

10 The ion-exchange agent is preferably a cation exchange-agent which comprises soil minerals, and most preferably exhibits a non-clay like behaviour with respect to swelling and shrinkage.

15 Micro-organisms can be very important to the growth of the plant. On the one hand such organisms play a role in plant protection, for example the occurrence plant diseases induced by pathogens and/or predators (such as phythium and Protozoa) are prohibited by both optimized crop conditions (such as sufficient nutrients) 20 and the appearance of antagonists, i.e. micro-organisms, of these pathogens and predators, and on the other hand, micro-organisms (such as mycorizha) can live in symbioses with the plant and in this way induce improved plant growth.

25 A good habitat for micro-organisms is available in materials containing pores with an average size of 6  $\mu\text{m}$  or less. Very good conditions are provided when the pores are smaller than 3 times the size of the micro-organisms, yet still larger than the organisms. Clay 30 (such as Bentonite) is an example of a material containing an average pore size  $< 6 \mu\text{m}$ . The porosity and average pore size of clay is not static but fluctuates considerably due to the swell and shrink behaviour of clay, which is influenced, amongst other things by the 35 pH-level, EC-level and water content.

Plant pathogens and predators are bigger in size than known antagonist and plant beneficial micro-

organisms. The latter are therefore more likely to profit from this smaller pore size.

In mineral wool plant substrates having a density of 10-200 kg/m<sup>3</sup> the average pore size is most 5 likely to be larger than 10 µm. Mineral wool plant substrates have a stable structure and porosity and are substantially not sensitive to swell and shrink behaviour.

In order to improve the mineral wool plant 10 substrate as a microbiological habitat, especially for plant protective micro-organisms, the ion-exchange agent preferably has an average pore size smaller than a mineral wool substrate of about 72 kg/m<sup>3</sup> (which has approximately an average pore size of 25 µm), preferably 15 also exhibits less swelling and shrinkage than clay and most preferably has an average pore size < 6 µm.

Most preferably the ion-exchange agent comprises a zeolite. Since zeolites have a stable, cage like structure they offer an ideal, stable habitat for 20 micro-organisms.

The substrate may further more comprise an organic substance like peat, coco, sphagnum or several types of compost, preferably to a degree of humification of 10-70%, more preferably comprising 10-60% humic acids 25 and/or nitrogen compounds (such as proteins, amino acids and amides) and most preferably originating from a natural source, which can substitute the mineral wool for upto 20 volume %, preferably upto 10 volume %.

Suitable organic substances are referred to in 30 WO 96/33602 which are included herein by reference.

pH control in cropping is often required for a good growth response. However, with mineral wool plant substrates good pH control is difficult to achieve. The pH resulting from the nutrient solution (based on the 35 required pH plant growth) often differs from the actual found pH in the mineral wool substrate. This is due to several reasons.

Firstly the mineral wool plant substrate behaves basic chemically, and therefore the pH in the substrate increases.

Secondly plants extrudate organic substances 5 from their surroundings which can influence pH.

Uptake of nutritional ions leads to the exclusion of  $H^+$  and  $OH^-$  by plant roots which can also influence the pH. Furthermore the state of the plant conditions, i.e. considering factors such as induced 10 stress can also influence the type and amount of nutrient uptake and exclusion of extrudates.

Organic substances are good at buffering  $H^+$  ions via ad- and de-sorption of  $NH_2$  groups and buffering of  $OH^-$  ions via carbon-acid like groups (such as fulvic and 15 Humic acids).

Organic matter is also susceptible to biological degradation, affecting structure, amount and function of the effective pH buffering groups and therefore the pH buffering capacity of the organic 20 matter. The degree of humification of organic substances is an indication for the possible degree and amount of degradation. Substances with a low degree of humification are more likely to degrade than substances with a high degree humification. However, by using biologically 25 degradable organic substances the mineral wool plant substrate provides further advantageous properties linked to the organic substance, being the provision of a carbon source. Further, due to the degradation of the organic substance plant stimulating compounds are released such 30 as humic acids and vitamins which are beneficial to plant growth. Chelate forming compounds which keep slight or insoluble trace elements in the nutrient solution may also be released. The organic substance preferably has a degree of humification varying between 10-70% in order to 35 provide good pH buffering and positive effects on degradation.

When it is desired to provide a mineral wool plant substrate with an improved water buffering capacity

with higher available amounts of water between pF 0.5 and 2 and/or a more intermediate and fixed IEC, it is worthwhile to partially substitute the mineral wool by an inorganic substance such as a natural clay. The clay may 5 substitute the mineral wool for up to 20 volume %.

Clay for substitution of the organic substance may comprise soil materials comprising hydrophilic particles preferably having a particle size below 20  $\mu\text{m}$ , such particles, for example, belonging to the class of 10 eroded minerals, such as clays, mixtures of clays with silt and sand having a clay fraction removable as sludge of at least 20%, and further bentonite, kaolin and the like. Particularly suitable are different naturally occurring types of clays or mixtures thereof, such as 15 young sea clay. Examples are clays comprising 0-100%, preferably 10-50% of particles having a size preferably being smaller than 20  $\mu\text{m}$ .

The use of clay provides another advantage when the organic substance is included in the matrix in the 20 form of a pellet. In this situation clay functions as a lubricating agent and as a material that reduces the compressibility of the pellet.

The combination of clay and organic matter forms a so called clay-humus complex which can lead to an 25 improved physical structure i.e. increased porosity, increased pore sizes and therefore a drier, more aerated structure.

Accordingly, the amount of clay may be used in order to change the biodegradable character of the 30 organic substance used. For example peat which is normally biodegradable may rendered substantially bio- undegradable due to the addition of clay to the pellet.

In this manner, clay may inhibit or retard the biodegradation of the inorganic substance.

35 The pellet may have a (particle) size of about 0.1-20 mm.

Due to the presence of clay and of peat the concentration of spore elements in the water residing within the mineral wool matrix may be controlled, due to

the sustained release of cations temporarily stored within the organic substance and/or clay.

The invention will now be further elucidated by reference to the following examples.

5

Example 1

A coherent growth substrate was prepared having the form of grow-blocks (10\*10\*6.5 cm) consisting of a coherent matrix of mineral wool to which a phenol-formaldehyde based binding agent and a wetting agent was applied. Prior to passage through a curing oven, zeolite in a quantity of 10 weight % (particle size 2-6 mm having a cation exchange Capacity of 80 meq/100 gram dry matter) was added to the matrix. The density of the coherent growth substrate amounted to 80 kg/m<sup>3</sup>. The CEC of the coherent growth substrate based on volume contained a CEC of 3-6 mmol/litre substrate. This buffer capacity was 12-25% of the optimal applied nutrient solution.

20 Example 2

A coherent growth substrate was prepared having the form of grow-blocks (10\*10\*6.5 cm) consisting of a coherent matrix of mineral wool to which a furan based binding agent was applied.

25

(Binding agents as described in WO 97/07664 are included herewith by reference)

Prior to passage through a curing oven, an equal mixture of 50% zeolite and 50% clay, which together formed a quantity of 10 weight % was added to the matrix. The density of the coherent growth substrate amounted to 80 kg/m<sup>3</sup>.

The CEC of the Zeolite was 80 meq/100 gram dry matter, particle size was 2-6 mm, and the average pore size was < 10  $\mu$ m.

The CEC of the Clay was 20 meq/100 gram dry matter, particle size was 2-6 mm and the average pore size was 5-12  $\mu$ m.

The average pore size of mineral wool matrix lay between 15-30  $\mu\text{m}$ .

The CEC of the coherent growth substrate based on volume of the substrate contributed to a total CEC of 5 2-4 mmol/liter substrate. This buffer capacity was 8-16% of the optimal applied nutrient solution.

Based on the volume of the coherent substrate, less than 1% of the total volume of the substrate contained an average pore size of less than 12  $\mu\text{m}$ .

10 The inventors have shown that was sufficient to establish two different ecological niches for micro-organisms of differing sizes compared to products without the addition of the ion exchange agent exhibiting only one ecological niche.

15 The added amount of clay contributed in an extra absolute amount of water of 1-2 volume% in pF range 0.5-1.5. The relative extra amount of water available in this pF range, increased from 2% for pF 0.5 to 14% for pF 1.3. Research indicated that the extra available amount 20 of 1.5% in clay induced an improved growth response for cucumbers of 3-4% in the first 30 days of growth when applying a water regime lying between pF 1 and 1.3.

### Example 3

25 A coherent growth substrate was prepared having the form of grow-slabs (100\*15\*7.5 cm) which consisted of a coherent matrix of mineral wool to which a Phenol-Formaldehyde based binding agent and wetting agent were applied. Prior to passage through a curing oven, a 30 mixture of 90% zeolite and 10% organic matter, together forming 12 weight % was added to the matrix. The density of the coherent growth substrate amounted to 57 kg/m<sup>3</sup>.

The CEC of the Zeolite was 80 meq/100 gram dry matter, particle size was 2-6 mm and the average pore 35 size was < 10  $\mu\text{m}$ .

The organic matter comprised more than 10% humic acid.

The average pore size of mineral wool matrix lay between 20-35  $\mu\text{m}$ .

The CEC of the coherent growth substrate based on volume of the substrate contributed to a total CEC of 5 2-4.5 mmol/litre substrate. This buffer capacity was 8-16% of the optimal applied nutrient solution.

Based on the volume of the coherent substrate, less than 0.5% of the total volume of the substrate contained an average pore size of less than 10  $\mu\text{m}$ .

10 Research indicated that this is sufficient to establish two different ecological niches for micro-organisms of differing sizes compared to products without the addition of the ion exchange agent exhibiting only one ecological niche.

15

Example 4

A coherent growth substrate was prepared having the form of growing blocks (10\*10\*6.5 cm) consisting of a coherent matrix to which a furan based binding agent was 20 applied.

Prior to passage through a curing oven, Clinoptilolite, a natural Zeolite (commercially available from the American company 'Zeopro'), in a quantity of 5 weight %, (having a CEC (cation exchange capacity) of 85 25 meq/100 gram dry matter), was added to the matrix. The density of the coherent growth substrate amounted to 80 kg/m<sup>3</sup>. The CEC of the coherent growth substrate based on volume contained a CEC of 4 mmol / litre substrate. This buffer capacity was 17-18% of the optimal applied 30 nutrient solution.

The invention is not limited to the above description; the requested rights are rather determined by the following claims.

## CLAIMS

1. Mineral wool plant substrate comprising a coherent matrix of mineral wool and upto 20 volume % of an ion-exchange agent comprising a variable and/or fixed ion-exchange capacity of about 15, preferably 30 and most 5 preferably 40meq/100g dry weight or more.

2. Substrate according to claim 1 wherein the ion-exchange agent is a cation-exchange agent.

3. Substrate according to claims 1 or 2 wherein the ion-exchange agent comprises soil minerals.

10 4. Substrate according to claims 1, 2 or 3 wherein the ion-exchange agent has a non-clay like behaviour with respect to swelling and shrinkage, and preferably has a stable zeolite, cage-like structure.

15 5. Substrate according to any of the previous claims wherein the ion-exchange agent has an average pore size smaller than the average pore size of mineral wool having a density of less than about 72 kg/m<sup>3</sup>.

6. Substrate according to any of the previous 20 claims wherein the ion-exchange agent comprises a zeolite.

7. Substrate according to any of the previous 25 claims further comprising an organic substance, preferably comprising sphagnum, peat, substituting the mineral wool for upto 20 volume %, preferably upto 10 volume %.

8. Substrate according to any of the previous claims further comprising clay, substituting the mineral wool for up to about 20 volume %.

9. Substrate according to any of the previous 30 claims for use as a growing block.

10. Substrate according to any of the claims 1-8 for use as a growing mat.

11. Substrate comprising a coherent matrix of mineral wool, a pre-determined amount of clay and a pre-determined amount of an organic substance, preferably comprising sphagnum, peat, substituting the mineral wool 5 for upto 20 volume %, preferably upto 10 volume %.

## MINERAL WOOL PLANT SUBSTRATE

## **ABSTRACT OF THE DISCLOSURE**

The invention relates to a mineral wool plant substrate comprising a coherent matrix of mineral wool and up to 20 volume % of an ion-exchange agent comprising a variable and/or fixed ion-exchange capacity of about 15, preferably 30 and most preferably 40meq/100g dry weight or more.

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09/762778

JC02 Rec'd PCT/PTO 13 FEB 2001

PATENT APPLICATION/PCT  
Attorney Docket No. 702-010062

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of :  
Anton BLAAKMEER : MINERAL WOOL PLANT SUBSTRATE  
Paul J. L. H. BOUWENS :  
  
International Application :  
No. PCT/EP99/05759 :  
  
International Filing Date :  
6 August 1999 :  
  
Priority Dates Claimed :  
14 August 1998 :  
  
Serial No. Not Yet Assigned :  
  
Filed Concurrently Herewith :  
  
Pittsburgh, Pennsylvania  
February 13, 2001

LETTER RECOGNIZING ATTORNEYS

**Box PCT**

Assistant Commissioner for Patents  
Washington DC 20231

Sir:

Enclosed are appropriate papers for initiating the national phase of the above-identified PCT application, comprising a specification, claims, drawing and abstract. A Preliminary Amendment is also enclosed.

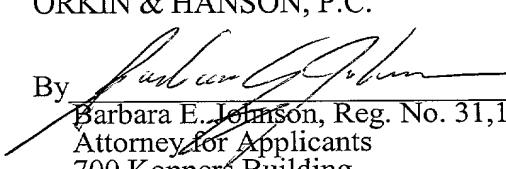
Please accept the application for purposes of granting a filing date and recognize Barbara E. Johnson, Richard L. Byrne and Thomas J. Clinton, Registration Nos. 31,198, 28,498 and 40,561, respectively, as attorneys in this application, pending the filing of a formal Declaration and Power of Attorney.

Kindly direct all communications relating to this application to **Barbara E. Johnson**.

Respectfully submitted,

WEBB ZIESENHEIM LOGSDON  
ORKIN & HANSON, P.C.

By

  
Barbara E. Johnson, Reg. No. 31,198  
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## Declaration and Power of Attorney For Patent Application

## English Language Declaration

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name,

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled mineral wool plant substrate

the specification of which

(check one)

is attached hereto.

was filed on 06 August 1999 as PCT/EP99/05759 and as

Application Serial No. 09/762,778, received 13 February 2001

and was amended on February 13, 2001  
(if applicable)

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to patentability of this application in accordance with Title 37, Code of Federal Regulations, §1.56.

I hereby claim foreign priority benefits under Title 35, United States Code, §119 of any foreign application(s) for patent or inventor's certificate listed below and have also identified below any foreign application for patent or inventor's certificate having a filing date before that of the application on which priority is claimed:

Prior Foreign Application(s)	Priority Claimed
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98202723.7	Europe	14 August 1998	<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> No
(Number)	(Country)	(Day/Month/Year Filed)		

			<input type="checkbox"/> Yes	<input type="checkbox"/> No
(Number)	(Country)	(Day/Month/Year Filed)		

			<input type="checkbox"/> Yes	<input type="checkbox"/> No
(Number)	(Country)	(Day/Month/Year Filed)		

I hereby claim the benefit under Title 35, United States Code, §120 of any United States application(s) listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States application in the manner provided by the first paragraph of Title 35, United States Code, §112, I acknowledge the duty to disclose material information as defined in Title 37, Code of Federal Regulations, §1.56(a) which occurred between the filing date of the prior application and the national or PCT international filing date of this application:

PCT/EP99/05759

(Application Serial No.)

6 August 1999

(Filing Date)

pending

(Status)

(patented, pending, abandoned)

(Application Serial No.)

(Filing Date)

(Status)

(patented, pending, abandoned)

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

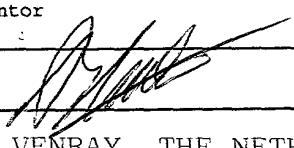
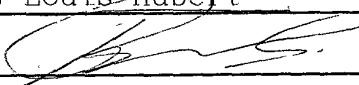
POWER OF ATTORNEY: As a named inventor, I hereby appoint the following attorney(s) and/or agent(s) to prosecute this application and transact all business in the Patent and Trademark Office connected therewith. (list name and registration number)

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David C. Hanson	23,024	John W. McIlvaine	34,219	Jesse A. Hirshman	40,016
Richard L. Byrne	28,498	Michael I. Shamos	30,424	James G. Porcelli	33,757
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(Supply similar information and signature for third and subsequent joint inventors.)